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ATTESTATION

I, Victor Theodore John Schenk BSc PhD MA MIL MITI, do declare:

(1) that I am a citizen of the United Kingdom of Great Britain and Northern Ireland, residing at 25 The Firs, Powdon, in the County of Cheshire,

(2) that I am well acquainted with the Japanese and English languages, and

(3) that the attached is a true and to the best of my abilities an accurate English translation made by me of Japanese Patent Gazette Publication No. 47-23389.

Victor T.J. Schenk
(11th November 1987)

DECLARED by Victor Theodore John Schenk in the presence of me at Altrincham, Greater Manchester this Eleventh day of November 1987.

.....
GRAHAME OLIVER HARRIS
Notary Public

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A method for improving the taste of artificial sweeteners

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Detailed Description of the Invention

The present invention relates to a method of enhancing the potency and improving the taste quality of artificial sweeteners. More particularly, it relates to a method of improving the taste of artificial sweeteners by using L-aspartyl-L-phenylalanine methyl ester together with saccharin or cyclamic acid (cyclamate), or with both, and its objective is to offer a method which synergistically enhances the potency of artificial sweeteners and at the same time markedly improves their taste quality.

It has recently been discovered in the United States that L-aspartyl-L-phenylalanine methyl ester (hereinafter abbreviated to APM), which is a type of dipeptide, exhibits extremely powerful sweetness. As a result of a detailed investigation into the taste characteristics of APM, the present inventors have discovered that if APM is mixed with saccharin or cyclamic acid (cyclamate), sweetness is markedly enhanced by a synergistic action between the inherent sweetness of the two components, and at the same time, the unpleasant taste which is a characteristic of artificial sweeteners is eliminated by this mixing, and the quality of the taste is dramatically improved. It is on this discovery that the present invention is based. The fact that there is such a marked sweetness-enhancing synergistic effect and taste quality improving effect between APM and saccharin or cyclamic acid/cyclamate in this way, is a completely novel discovery.

APM does not readily produce the said synergistic effect with any sweetener, and as a result of an investigation into a very large number

of sweeteners ranging from various types of sugars including dextrose, fructose and sorbitol, etc, to amino acids with sweetness, glycyrrhizin, dulcin and other such sweeteners, it has been found to be a highly specific phenomenon noted only with the aforesaid two sweeteners. In other words, it has become clear that it is far more economic and effective to use APM along with saccharin or cyclamic acid (cyclamate) than by itself.

Experimental results relating to the aforesaid synergistic effect on sweetness and the taste quality improving effect will now be described. The taste-testing panel used in the experiment comprised about 100 testers selected from about 1000 men and women on the basis of the results of a strict testing of the sensitivity of their sense of taste.

Examples

(1) When measurements were made of the potency of solutions of a single artificial sweetener in comparison with sucrose, the results shown below were obtained. The measurement method involved the determination of concentrations of artificial sweetener and sucrose of equivalent sweetness by 25 of the aforesaid taste testers. That is to say, a specific concentration of the test material was used as the measurement sample, various concentrations of sucrose were respectively grouped, and a comparison made. On each occasion, an assessment was made as to which was sweeter, and the data obtained was analysed by the Probit method. In this way, the concentration of sucrose with an equivalent sweetness strength to that of the particular test material was measured. (Detailed data has been omitted, and only the results are provided).

[Table 1]

Name of Sweet Substance	Equivalent Concentrations of Artificial Sweetener and Cane Sugar (g/dl)			
APM	0.025	0.050	0.10	-
sucrose	3.54	5.73	9.41	-
sodium saccharin	0.005	0.01	0.02	0.04
sucrose	2.2	3.5	5.5	7.4
sodium cyclamate	0.05	0.1	0.2	0.4
sucrose	1.5	3.0	6.0	11.5

When the potency of sweet substances is compared based on sucrose, it is found that there are those such as dextrose where the potency factor increases with concentration, those such as sodium cyclamate where it is practically constant, and those like saccharin where, conversely, it slowly falls with concentration. In this respect, APM corresponds to the case of saccharin. At low concentrations, its potency is about 140 times that of sucrose, while at high concentrations it is about 90 times. Hence, for this reason too, rather than being used on its own, having a method of enhancing sweetness with another substance is desirable for making APM all the more effective.

(2) The synergistic effect on sweetness of using APM plus other sweeteners:

An investigation was carried out to determine whether or not the resulting potency was greater than the mere sum of the individual potencies when APM and the other sweeteners shown in Table 2 below were mixed together.

When a comparison was made by 30 taste testers between the sweetness

strength of mixtures of APM and another sweetener, and the sweetness strength of a sucrose solution of concentration equivalent to the sum of the respective strengths of the individual components in the mixtures (converted to sucrose), and again of the sweetness strength of a sucrose sugar solution of concentration somewhat greater than this sum in each case, the following results were obtained.

Table 2: Enhancement of sweetness in mixtures of APM and other sweeteners (n = 30 testers)

Samples Compared		Assessment Result		Statistical Significance	
S (g/dl)	R (sucrose)	S > R*	R > S**		
APM 0.025 + sucrose 3	6.54 (3.54 + 3)	14	16	-	
APM 0.05 + sucrose 6	11.73 (5.73 + 6)	13	17	-	
APM 0.025 + saccharin 0.01	7.04 (3.54 + 3.5)	30	0	+++	
	9.0	27	3	+++	
APM 0.025 + saccharin 0.04	10.94 (3.54 + 3.5)	27	3	+++	[sic]
	13.0	26	4	+++	
APM 0.05 + saccharin 0.01	9.23 (5.73 + 3.5)	29	1	+++	
	11.0	25	5	+++	
APM 0.05 + saccharin 0.04	13.13 (5.73 + 7.4)	26	4	+++	[sic]
	15.0	21	7	+++	
APM 0.1 + saccharin 0.005	11.61 (9.41 + 2.2)	30	0	+++	
	14.0	29	1	+++	
APM 0.025 + saccharin 0.04	10.94 (3.54 + 7.4)	23	7	++	
	13.0	22	8	++	
APM 0.025 + saccharin 0.005	5.74 (3.54 + 2.2)	30	0	+++	
	8.0	26	4	+++	

APM 0.025 + sodium cyclamate 0.1	5.04 (3.54 + 1.5)	30	0	—
	6.0	27	3	—
APM 0.025 + sodium cyclamate 0.2	9.54 (3.54 + 6.0)	30	0	—
	11.0	25	5	—
APM 0.05 + sodium cyclamate 0.1	8.73 (5.73 + 3.0)	30	0	+++
	10.0	29	1	+++
APM 0.05 + sodium cyclamate 0.2	11.73 (5.73 + 6.0)	28	2	+++
	13.0	27	3	+++
APM 0.1 + sodium cyclamate 0.05	10.91 (9.41 + 1.5)	27	3	+++
	13.0	24	6	+++
APM 0.025 + sodium cyclamate 0.4	14.09 (3.54 + 11.5)	25	5	+++
	16.0	21	9	+
APM 0.025 + sodium cyclamate 0.05	5.04 (3.54 + 1.5)	30	0	+++
	7.0	30	0	+++

Notes:
* number of testers who rated S as being sweeter than R
** number of testers who rated R as being sweeter than S

\- no statistically significant difference
\+ significant difference at the 5% level of significance
++ significant difference at the 1% level of significance
+++ significant difference at the 0.1% level of significance

As is clear from the results in Table 2 above, while no special effect was noted between APM and sucrose, when APM was mixed with saccharin or cyclamate a marked synergistic effect was found over a wide range of blending ratios.

Now, if the sweeteners used here were sweeteners like dextrose which show an increase in potency factor along with increase in concentration, then even if the potency of a mixture were to be greater than the respective sum of the individual potencies, this may merely be an additive effect. However, in the case of APM, sodium saccharin and sodium cyclamate, the respective potency factors are either of the constant or reducing type, and so if the potency of a mixture is greater than the sum of the individual potencies, this is clearly a synergistic effect in terms of taste.

(3) Improving taste quality by mixing APM with other sweeteners:

Next, a comparison was made by 30 taste testers, using a ranking method, of the pleasantness of the flavour in the case of solutions of APM, sodium saccharin and sodium cyclamate of individual concentrations adjusted to give about the same degree of sweetness, plus mixtures of half or one quarter the amounts of APM and sodium saccharin, or APM and sodium cyclamate. Table 3 below shows the compositions of the various samples. Further, Table 4 shows the results obtained. In each case there was a significant difference based on the Friedman test, and it is evident that there was a clear taste quality improving effect from mixing APM and saccharin or cyclamic acid (cyclamate).

Table 3

A : APM 0.05g/dl
B : sodium saccharin 0.022g/dl
C : sodium cyclamate 0.195g/dl

AB : APM 0.025g/dl + sodium saccharin 0.011g/dl

A'B' : APM 0.013g/dl + sodium saccharin 0.006g/dl

AC : APM 0.025g/dl + sodium cyclamate 0.1g/dl

A'C' : APM 0.013g/dl + sodium cyclamate 0.05g/dl

Table 4: Results of a comparison of the pleasantness of taste (n = 30 testers)

	Test I			Test II			Test III			Test IV		
	A	B	AB	A	B	A'B'	A	C	AC	A	C	A'C'
Rank 1*	3	6	21	10	2	18	8	2	20	10	5	15
Rank 2	20	5	5	17	5	8	18	5	7	14	8	8
Rank 3	7	19	4	3	23	4	4	23	3	6	17	7
Rank total	64	73	43	53	81	46	56	81	43	56	72	52

Note:

* The figures in the table are the number of taste testers who ranked the sweetener solution at a particular level (ie Ranks 1, 2, or 3)

Claim

A method of improving the taste of artificial sweeteners by using L-aspartyl-L-phenylalanine methyl ester together with saccharin and/or cyclamic acid (cyclamate).